AM-1 EOS GROUND SYSTEM INTEGRATION AND TEST

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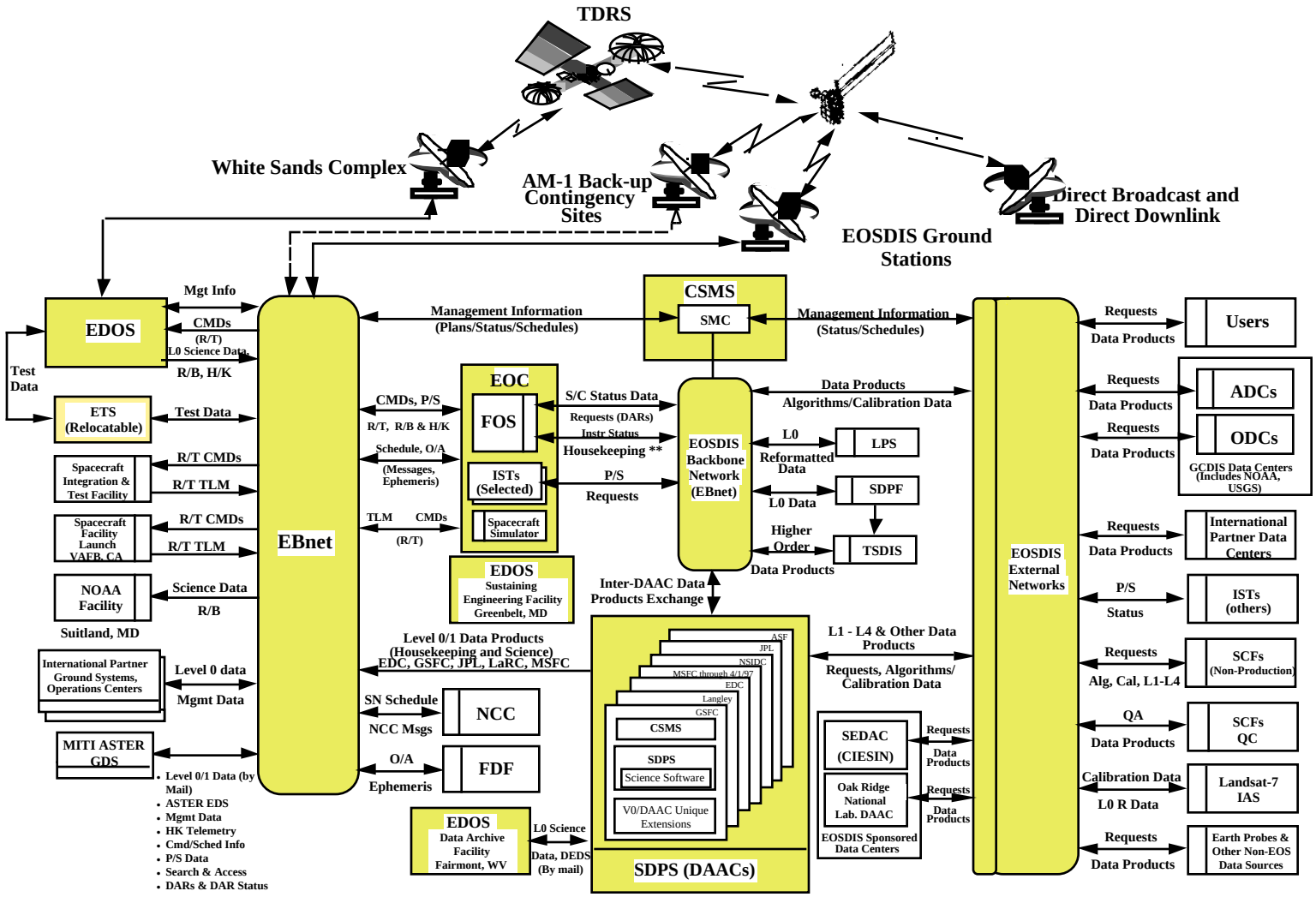
AM-1 EGS I&T Topics

- EGS I&T Overview and Approach
- EGS Confidence Tests
- Joint Flight-Ground Tests
- EGS I&T Tools & Test Data
- Schedules
- Concerns
- Wrap-up

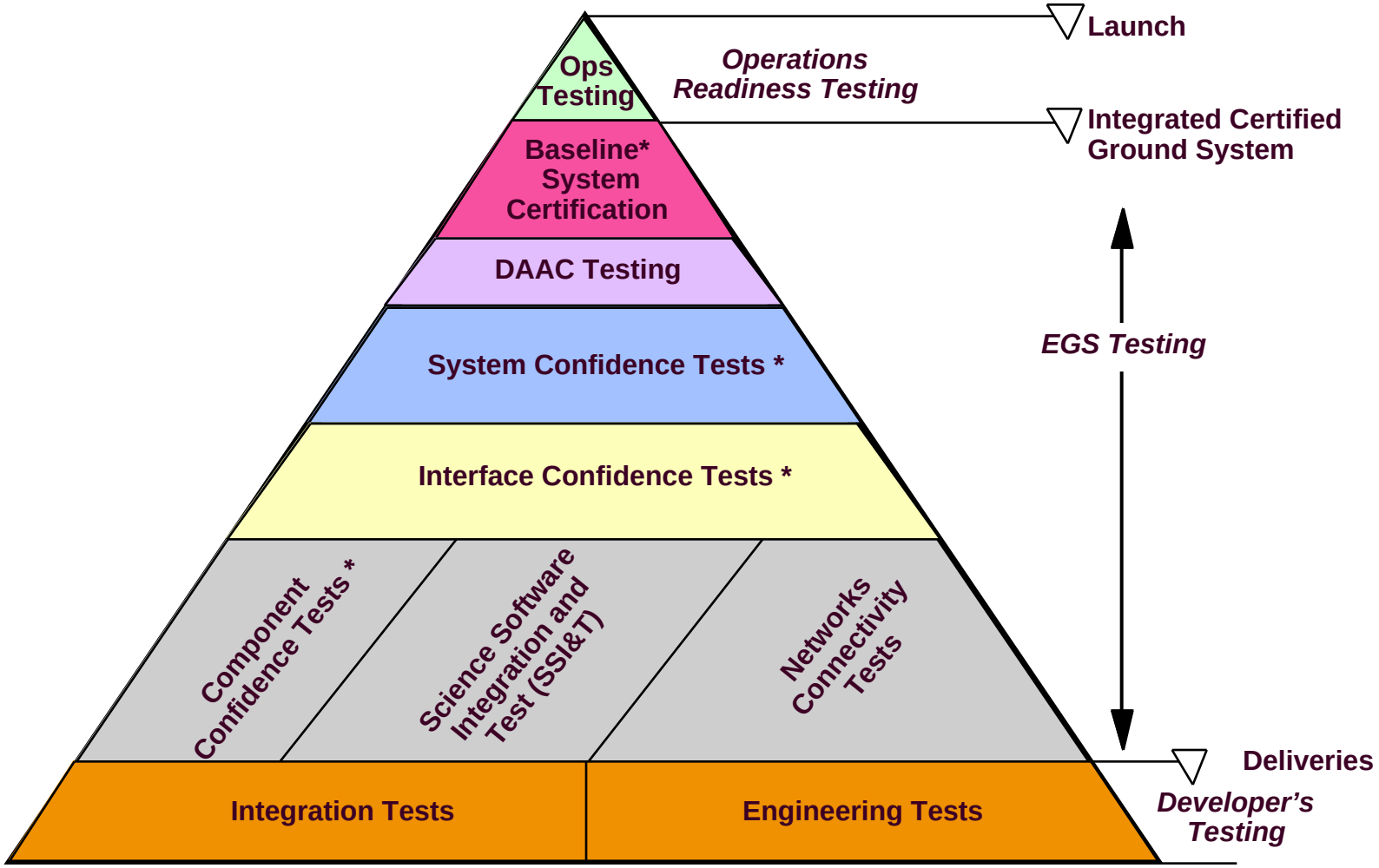
EOS Ground System Diagram



EGS I&T Program Approach

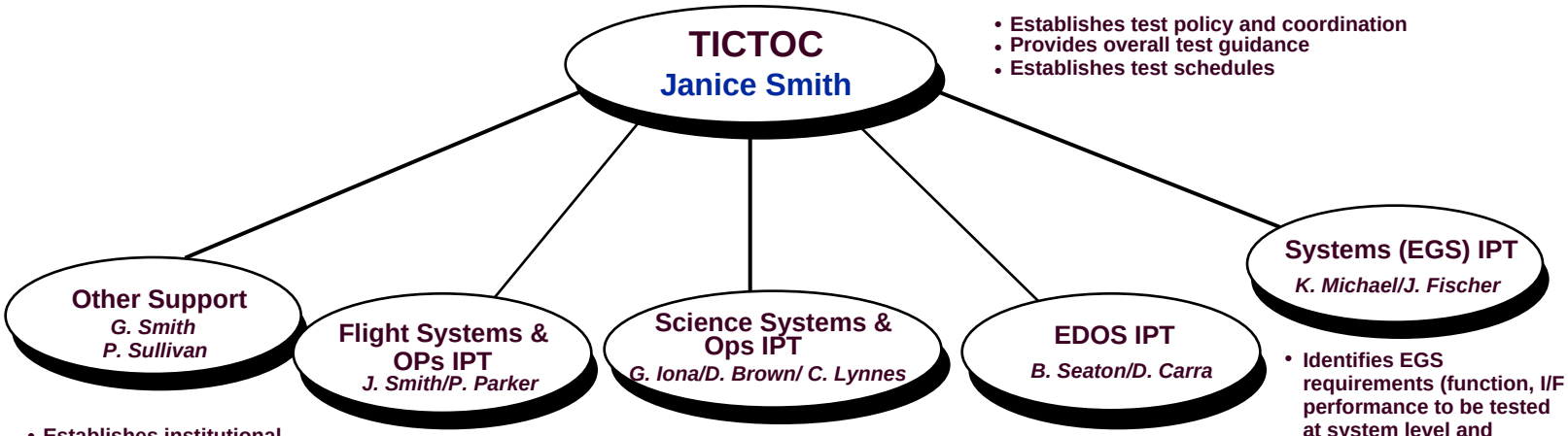
- EGS test hierarchy shows building block approach from development integration and engineering tests to EGS I&T and ultimately operations readiness testing
- ESDIS established Test, Integration and Certification Test Oversight Committee (TICTOC) to coordinate EGS testing activities across multiple organizations; convenes biweekly
- TICTOC uses Integrated Product Teams (IPTs) composed of EOSDIS developers, testers, operations, Flight Projects, external (e.g., ASTER GDS) and institutional system representatives; IPTs convene regularly

EGS Test Hierarchy



* Indicated EGS I&T activities

EGS I&T TICTOC/IPT Concept



- Establishes institutional upgrades and need dates
- Defines institutional test plans
- Defines network need dates and tests
- Conducts connectivity tests and supports functional tests
- Members: 530, 540, EBnet, Institutionals

- Identifies mission critical, I/F, and performance requirements to be tested and defines acceptance criteria
- Defines/conducts post-delivery FOS testing
- Generates test package for each scenario/thread
- Establishes detailed test schedule and coordinates resource needs
- Members: EGS I&T, ECS, FOT, IOTs , ETS, EDOS, EBnet

- Identifies mission critical, I/F, and performance requirements to be tested and defines acceptance criteria
- Identifies simulation science test data needs
- Defines/conducts post-delivery SDPS/CSMS testing
- Generates test package for each test scenario/thread
- Establishes detailed test schedules and coordinates resource needs
- Members: EGS I&T, ECS, ITs, DAACs, M&O, ETS, EDOS, EBnet

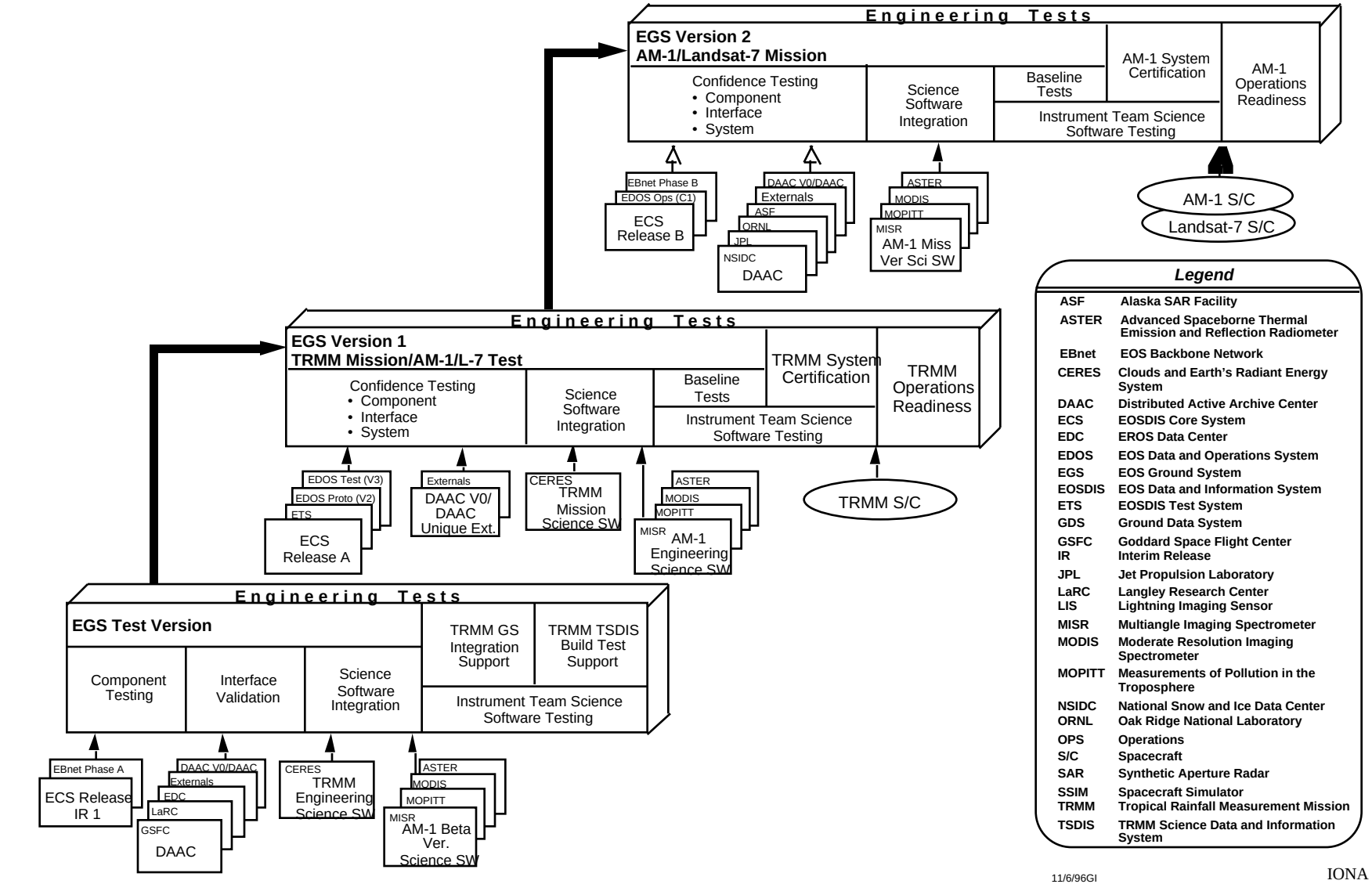
- Identifies mission critical, I/F, and performance requirements to be tested and defines acceptance criteria
- Defines/conducts post-delivery EDOS testing
- Generates test package for each scenario/thread
- Establishes detailed test schedules and coordinates test resource needs
- Members: EDOS, M&O, EBnet, EGS I&T

- Identifies EGS requirements (function, I/F performance to be tested at system level and defines acceptance criteria
- Defines/coordinates EGS tests on mission basis:
  - TRMM
  - Landsat
  - AM-1
  - ASTER
- Establishes joint flight/ground project test schedules; facilitates engineering tests
- Defines system certification tests (mission basis per EGS version)
- Conducts EGS tests
- Members: Mission Coordinators, Flight Projects, S/C, externals, other IPTs

EGS I&T Program Structure

- EGS I&T program structured around EGS Version 1 (TRMM) Mission and Version 2 (AM-1/Landsat-7). New systems integrated & tested as they are delivered
- EGS I&T program validates EGS mission critical requirements, IRDs/ICDs, mission Level 2 requirements, and system performance requirements
- EGS I&T Confidence Testing developed using the TICTOC/IPTs
  - Component (ECS, EDOS, EBnet)
  - Interface (EOSDIS internal, EGS, and externals)
  - System (end-to-end performance, ECTs, baseline system certification)
- Joint Flight/Ground Project Testing
  - Coordinate EGS support for AM-1, TRMM, Landsat 7, ASTER GDS test activities.
  - Goal to consolidate Flight Project tests (including ASTER GDS) with EGS I&T confidence tests where practical
- EOSDIS development organizations conduct engineering interface tests as needed

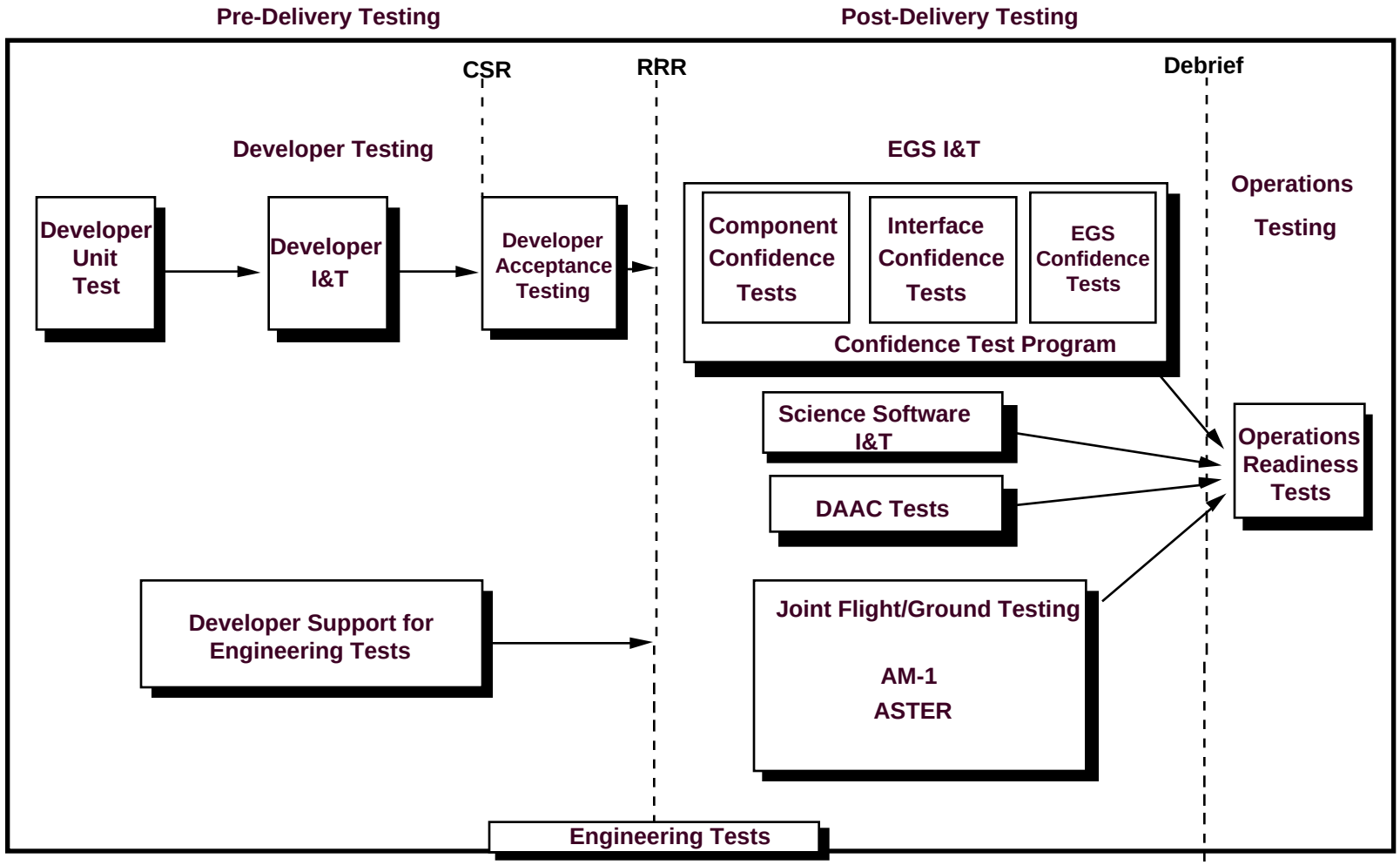
EGS Version Implementation



Legend

ASF	Alaska SAR Facility
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
EBnet	EOS Backbone Network
CERES	Clouds and Earth's Radiant Energy System
DAAC	Distributed Active Archive Center
ECS	EOSDIS Core System
EDC	EROS Data Center
EDOS	EOS Data and Operations System
EGS	EOS Ground System
EOSDIS	EOS Data and Information System
ETS	EOSDIS Test System
GDS	Ground Data System
GSFC	Goddard Space Flight Center
IR	Interim Release
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
LIS	Lightning Imaging Sensor
MISR	Multiangle Imaging Spectrometer
MODIS	Moderate Resolution Imaging Spectrometer
MOPITT	Measurements of Pollution in the Troposphere
NSIDC	National Snow and Ice Data Center
ORNL	Oak Ridge National Laboratory
OPS	Operations
S/C	Spacecraft
SAR	Synthetic Aperture Radar
SSIM	Spacecraft Simulator
TRMM	Tropical Rainfall Measurement Mission
TSDIS	TRMM Science Data and Information System

EGS Test Flow



EGS I&T Component Confidence Tests

EOC Component

– Telemetry Processing in EOC1
– Command Processing in EOC2
– Planning & Scheduling in EOC3
– Telemetry Logging & Analysis in EOC4
– Resource Management in EOC5

SDP Component

– Data Ingest & Archive in SDP1
– Science Data Production in SDP2
– Data Access & Transfer in SDP3
– System Administration in SDP4
– V0/ECS Interoperability in SDP5
– Data Manipulation in SDP6

- **ECS component confidence tests performed by Code 505**
- **EDOS component confidence tests are performed by Code 510**
- **EBnet/NSI circuit installation tests are performed by Code 540**
- **Networks tests performed by Code 532**

EGS I&T Interface Confidence Tests

- DAAC – SCF tested in ICT1
- EDOS – EOC tested in ICT2
- EDOS – DAAC tested in ICT3
- DAAC – ADC tested in ICT4
- ECS GSFC DAAC – DAO tested in ICT5
- EOC – NCC tested in ICT9
- EOC – FDD tested in ICT10
- EDOS – ASTER GDS (AOS/SDPS) tested in ICT11
- ECS – ASTER GDS tested in ICT12
- EOC – ISTs/ASTER ICC tested in ICT13
- EOC – ASTER GDS tested in ICT14

Note: ICT6 through ICT8 not related to AM-1

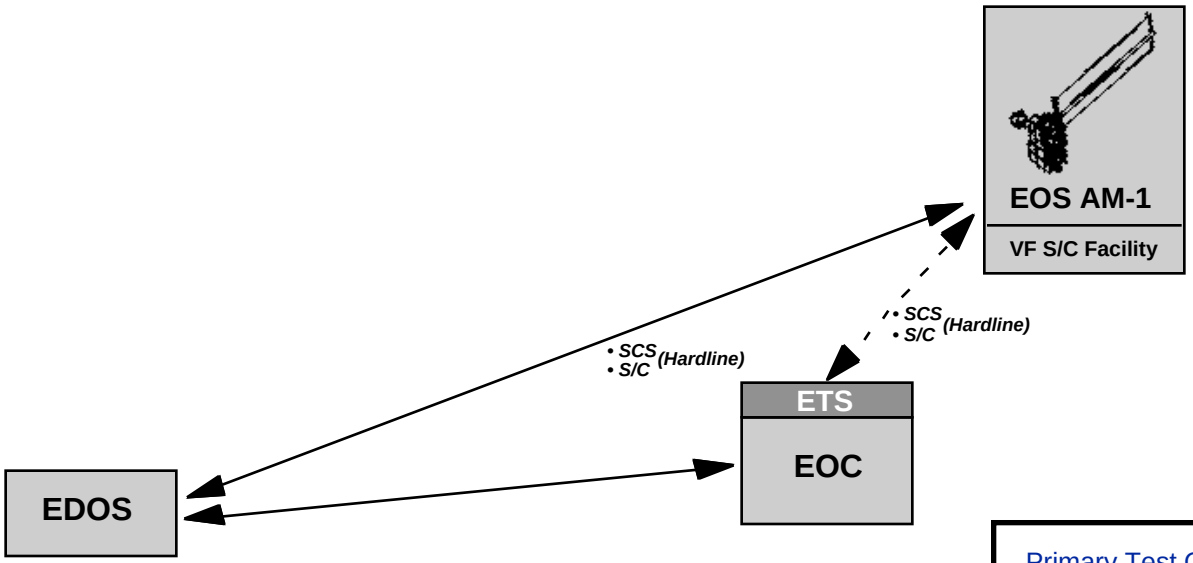
EGS I&T System Confidence Tests

- **AM-1 spacecraft operations in EGS1 –** SN daily operations test for command and telemetry
- **AM-1 contingency mode operations in EGS2 –** WOTS, Alaska, and Norway backup command and telemetry
- **AM-1 daily operations in EGS3 –** Day in the life test; includes EGS1 plus data ingest, archive, processing, access, and distribution
- **ASTER operations in EGS6 –** Day in the life test for ASTER GDS
- **EOSDIS security in EGS7**
- **EGS version baseline and certification testing**
  - Version 1 baseline tests establishes confidence in early system capabilities of EGS
  - Version 2 baseline test certifies EGS capabilities to support AM-1 launch and operations
  - EGS Version 2 certification complete and ready to support operations testing in March 1998 (TBR)

Joint Flight-Ground Tests

- **Three AM-1 spacecraft/EGS compatibility tests were defined with each test building on previous test objectives and configuration**
- **ECT1 status**
  - **IPT meeting regularly to discuss EOC Compatibility Test 1 (ECT1) activities with spacecraft, EDOS, ECS, EBnet, FOT, AM-1, ESDIS, and EGS I&T**
  - **Excellent IPT support and progress to date from all organizations**
    - » First ECT meeting held April 1996 at Valley Forge to discuss primary and secondary objectives for all ECTs
    - » ECT1 limitations meeting held October 8, 1996 to discuss spacecraft and ground system limitations for ECT1
- **Status for ECT2 and ECT3**
  - **Draft test packages with objectives and configuration prepared**
  - **ECT1 IPT will transition into preparation for ECT2 and ECT3 starting January 1997**

EOC Compatibility Test 1



Primary Test Objectives
- Command database validation
- Simple real-time commanding (2K)
- Housekeeping telemetry decommutation (16K)

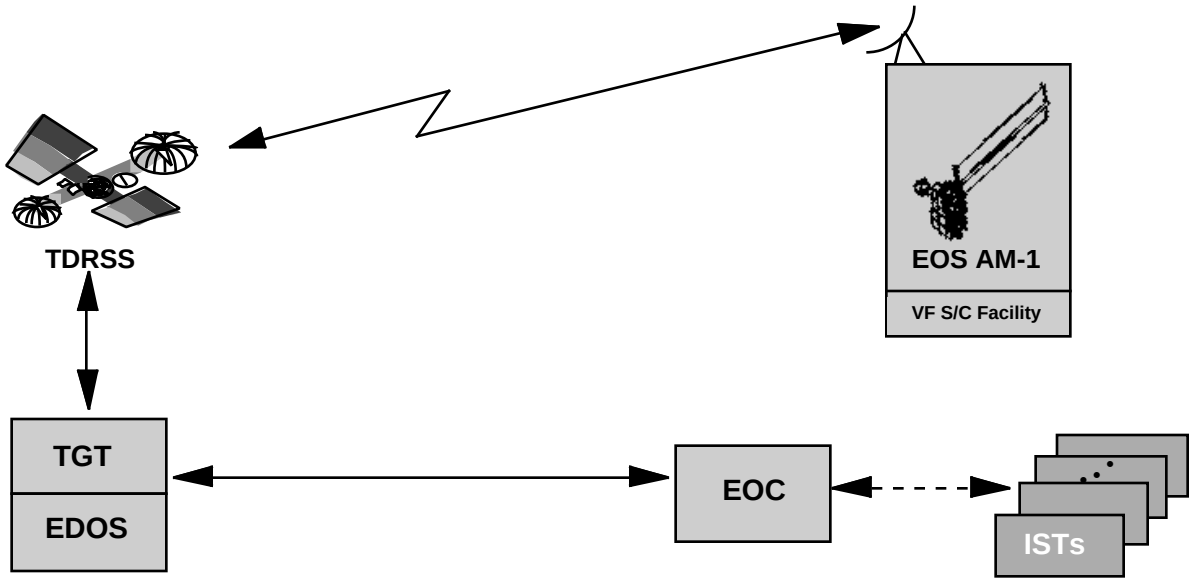
Secondary Test Objectives
- EOC/EDOS forward-link processing (1K & 10K)
- EOC/EDOS return-link processing (1K)

Resources
- ECS FOS Release A,
- EDOS Version 2
- Spacecraft, SCS
- EBnet hardline EOC, EDOS, Valley Forge

Duration
- 1 day/Jan, 1997

– Primary Data Flow
– Backup Data Flow

EOC Compatibility Test 2



Test Objectives (Primary)
- All command rates via TDRSS
- Command receipt and execution
- Receive and process all telemetry rates via TDRSS
- SSR dumps
- Spacecraft memory loads/dumps
- SSM management
- S/C clock correlation

Secondary Test Objectives
- IST telemetry monitoring
- Remove duplicate HK packets (CERES)

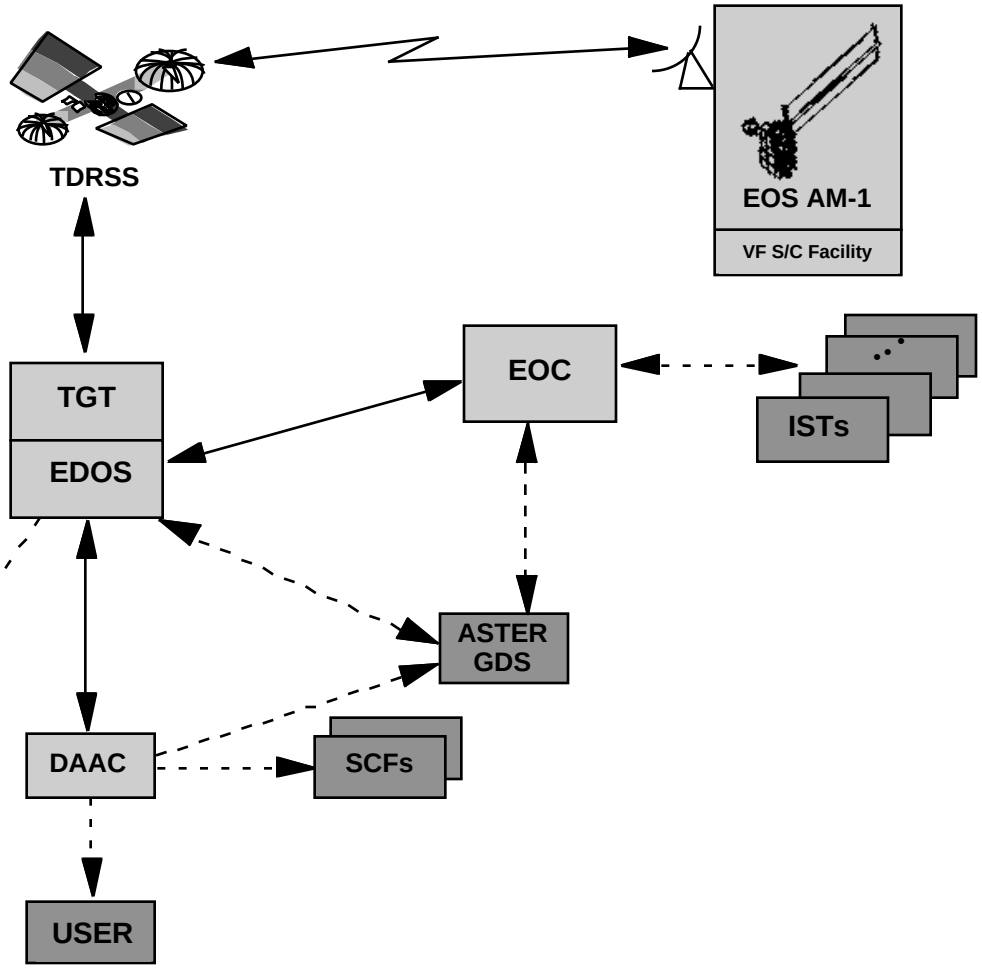
Resources
- ECS FOS Release B (predelivery)
- EDOS Version 3
- Spacecraft, SCS
- TDRSS
- NCC

Duration
- 2 days/July, 1997

– Primary Data Flow
– Secondary Data Flow

***Dry runs and pre-test activities will use ETS**

EOC Compatibility Test 3



***Dry runs and pre-test activities will use ETS**

Test Objectives (Primary)
- Science data to DAACs via EDOS
- Generate and uplink, all loads (i.e., instrument,FSW, ATC)
- Diagnostic dumps

Secondary Test Objectives
- IST loads & monitoring
- ASTER GDS data flows
- SCF, NOAA, user data flows

Resources
- ECS FOS Release B*, ECS DAACs Release B*
- EDOS Configuration 1*
- Spacecraft, SCS
- TDRSS
- NCC
- ASTER GDS
- ISTs

*indicates launch versions of systems

Duration
- 4 days/Jan, 1998

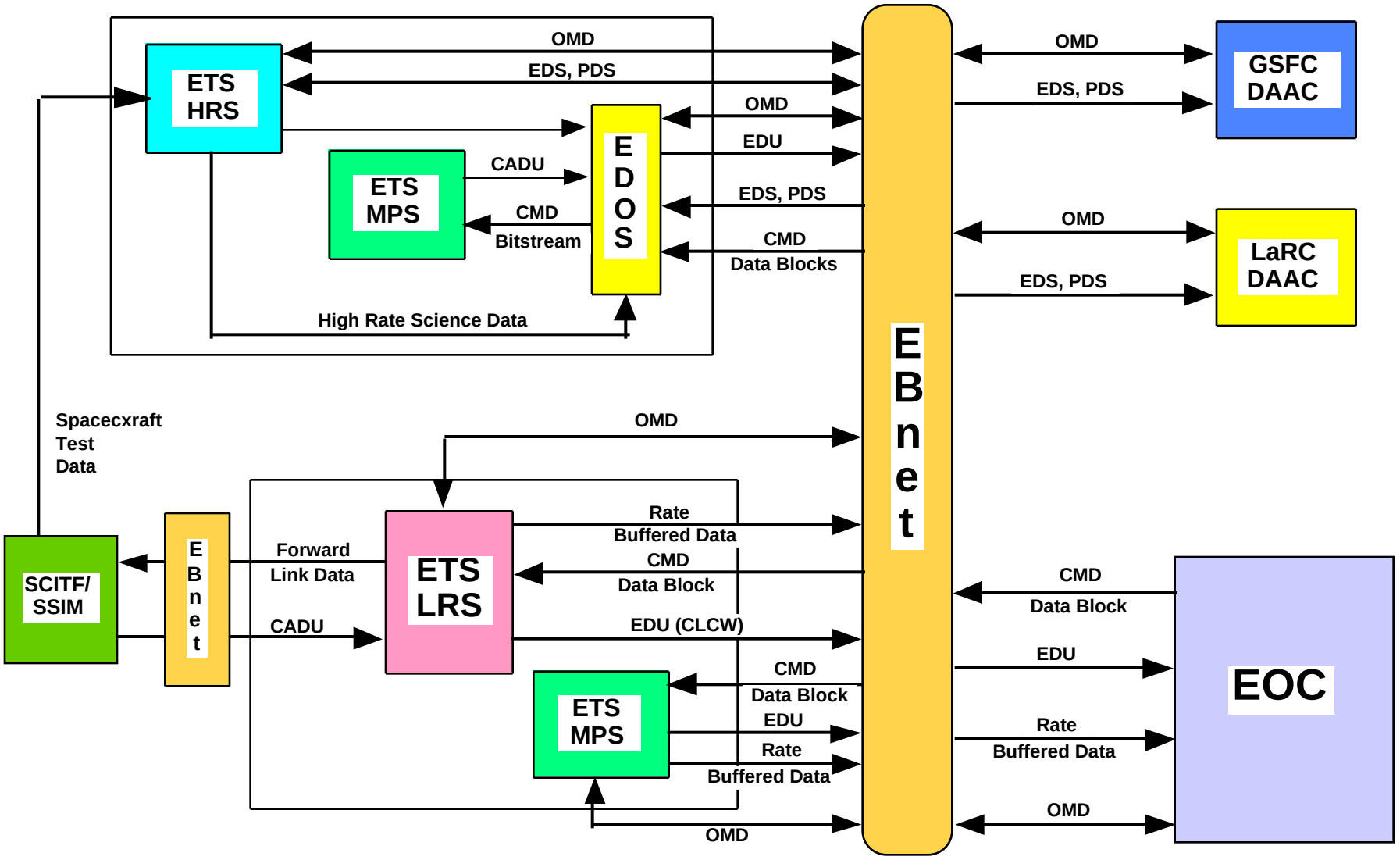
EGS I&T Tools and Test Data

- **ESDIS has developed a series of link home pages for information related to EGS I&T tools, test data, confidence test packages, schedules and meetings**
  - **ESDIS I&T home page:** http://esdis.gsfc.nasa.gov/integ/integ.html
  - **EGS I&T contractor home page:** http://fairmont.ivv.nasa.gov/it
- **Test Data Management (TDM) Tool host information on available test data sets (159 identified), test resources (18 identified), and test data needs (203 requests posted)**
- **Resource Allocation Tool (RAT) used for EGS I&T internal scheduling forecasting and conflict resolution. Usage being considered for EOSDIS operational systems scheduling**
- **Discrepancy Report (DR) Tracking Tool (DRTT) is used to record and track DRs documented as a result of EGS I&T activities**

EGS I&T Tools and Test Data (Cont'd)

- **ETS is the main test tool for EGS I&T and it consists of three unique simulators**
- **Multi-mode Portable Simulator (MPS)**
  - Low fidelity spacecraft simulator which uses AM-1 PDB to support testing of the forward and return (non-science) links.
  - Generate and transmit low rate spacecraft data (CADU/EDUs)
  - Receive and verify spacecraft commands (bitstream/command data blocks)
  - Simulate EDOS data formats (rate buffered data/OMD)
- **High Rate System (HRS)**
  - EOSDIS return link science data processing and interface test tool
  - Simulate TGT transmission for input to EDOS
  - Simulate EDOS transmission of data sets to DAACs
  - Simulate DAAC reception of data sets from EDOS
  - Process recorded spacecraft science data to generate EDOS compatible data sets
- **Low Rate System (LRS)**
  - Functional EDOS interface between the EOC and either SCITF or SSIM
  - Perform EDOS return link processing on low rate CADUs received from SCITF or SSIM
  - Perform EDOS forward link processing on command data blocks from EOC
  - Generate and transmit OMD messages to EOC reflecting data processed

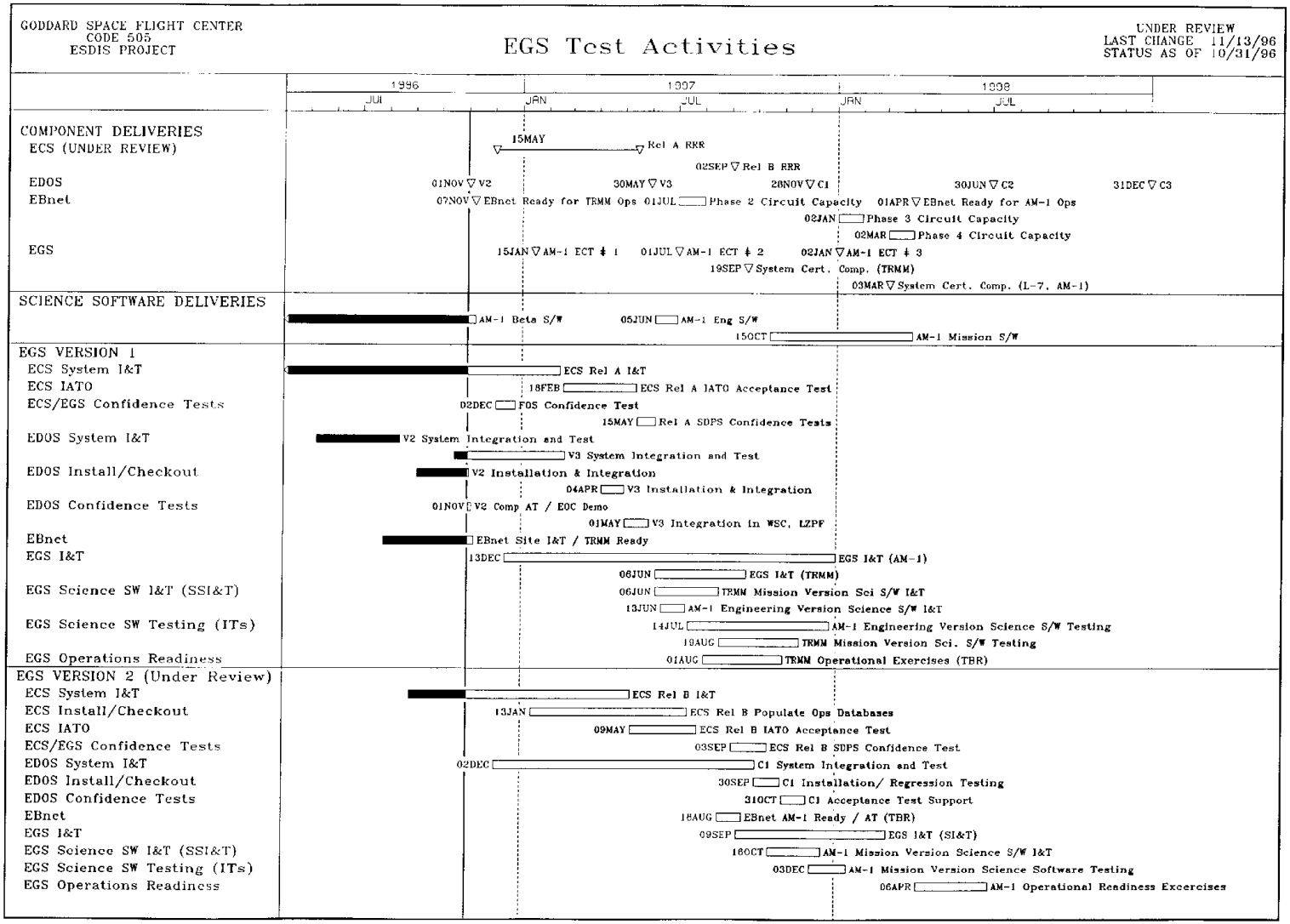
ETS Context


ETS HRS
OMD
EDS, PDS
ETS MPS
CADU
CMD
Bitstream
EDOS
OMD
EDU
EDS, PDS
CMD
Data Blocks
High Rate Science Data
EBnet
OMD
EDS, PDS
GSFC DAAC
OMD
EDS, PDS
LaRC DAAC
Spacecxraft Test Data
SCITF/ SSIM
EBnet
Forward Link Data
CADU
ETS LRS
OMD
Rate Buffered Data
CMD Data Block
EDU (CLCW)
ETS MPS
CMD Data Block
EDU
Rate Buffered Data
OMD
CMD Data Block
EDU
Rate Buffered Data
OMD
EOC

EGS Replan Schedule Status

- ECS Release B SDPS/CSMS delivery schedule being replanned
- ECS FOS and EDOS on schedule
- EGS schedule for Version 1 and Version 2 test activities being evaluated to reflect ECS replan

EGS Test Activities Schedule



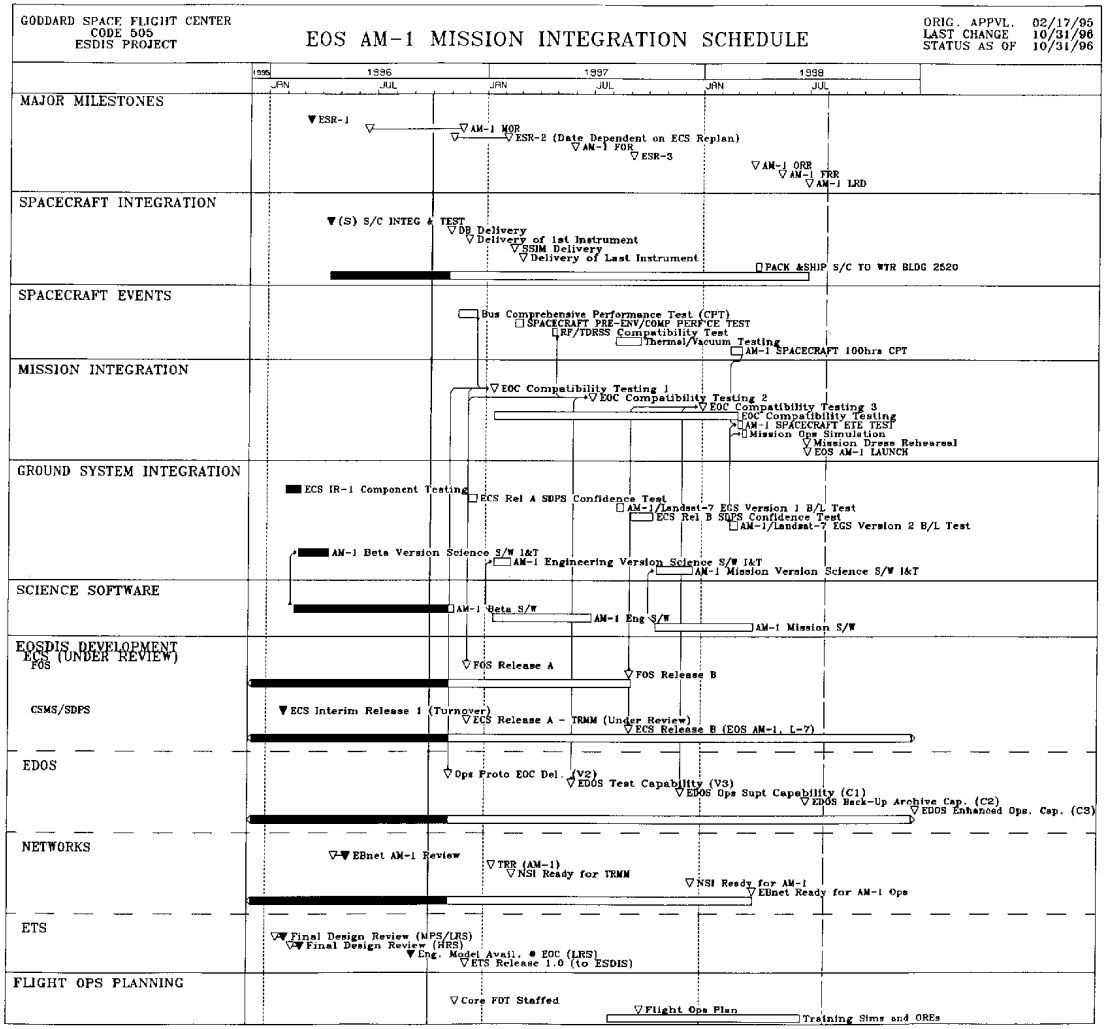
Concerns

- **ECS Release B SDPS/CSMS schedule replan**
  - **Impact: Compressed schedule for conducting EGS testing and operations simulations**
  - **Action: ESDIS is evaluating what-if scenarios for EGS testing and operations simulations against ECS Release B replan**

EGS Next Steps

- Begin Version 1 EGS I&T activities starting December 1996
- Revise EGS I&T schedules by January 1997 to reflect ECS Release B SDPS/CSMS replan
- Continue ECT1 IPT and conduct test in January 1997
- Continue to evolve EGS confidence test packages via IPTs and external participation

AM-1 Mission Integration



ASTER Integration